WHAT IS CLAIMED IS:

1. An image display device provided with transmitting means for providing image information to illumination light and for transmitting said light as an optical image signal and display means for receiving said optical image signal and for displaying an image based on said image information, said image display device comprising:

projecting optical means composed of a reflecting part for reflecting said optical image signal, and a refracting optical part for correcting for a distortion if said reflecting part has said distortion and for projecting said optical image signal onto said reflecting part;

wherein said display means receives said optical image signal through said projecting optical means.

2. An image display device provided with transmitting means for providing image information to illumination light and for transmitting said light as an optical image signal and display means for receiving said optical image signal and for displaying an image based on said image information, said image display device comprising:

projecting optical means composed of a reflecting part having a reflecting surface for reflecting said optical image signal, and a refracting optical part having a refracting surface for projecting said optical image signal onto said reflecting part;

wherein:

said display means receives said optical image signal through said projecting optical means; and

at least one of said reflecting surface and said refracting surface is aspherical.

3. The image display device according to claim 1, wherein said

transmitting means comprises:

an illumination light source part for emitting illumination light; and

a reflecting type image information providing part for receiving said illumination light emitted from said illumination light source part and for providing image information to said illumination light and reflecting said illumination light as said optical image signal.

4. The image display device according to claim 1, wherein said reflecting part has a rotationally symmetric aspherical surface for reflecting said optical image signal transmitted from said transmitting means.

5. The image display device according to claim 1, wherein said reflecting part is a convex mirror of negative power.

6. The image display device according to claim 1, wherein said reflecting part is a Fresnel mirror of negative power.

7. The image display device according to claim 1, wherein said reflecting part has a reflecting surface that is formed by a low dispersive medium and a high dispersive medium stacked in the direction in which to transmit said optical image signal sent from said transmitting means, has a negative power and reflects said optical image signal having passed through said low and high dispersive media.

8. The image display device according to claim 1, wherein said reflecting part has a reflecting surface formed so that its curvature is large around an optical axis and becomes smaller toward the periphery of said reflecting surface.

9. The image display device according to claim 1, wherein said reflecting part has an odd-order aspherical reflecting surface obtained by adding odd-order terms to a polynomial composed of even-order terms.

2 ~~10.~~ The image display device according to claim 1, wherein said

refracting optical part has odd-order aspherical refracting surfaces obtained by adding odd-orders term to a polynomial composed of even-order terms.

11. The image display device according to claim 9, wherein said reflecting part or refracting optical part reflects or refracts said optical image signal by said reflecting or refracting surface except around the optical axis of said reflecting or refracting part.

12. The image display device according to claim 1, wherein said refracting optical part is provided with a curvature-of-field correcting means for canceling a curvature of field of said reflecting part.

13. The image display device according to claim 12, wherein said refracting optical part is provided with: a positive lens of positive power; a negative lens of negative power and having a refractive index lower than that of said positive lens; and a Petzval's sum correcting lens for correcting for a Petzval's sum contributing component of said reflecting part.

14. The image display device according to claim 1, wherein said projecting optical means has an aspherical optical surface at places where principal rays of said optical image signal to be projected onto the reflecting part from said transmitting means are divergent and/or convergent.

15. The image display device according to claim 1, wherein said projecting optical means is provided with path-bending means for reflecting said optical image signal from said refracting optical part to said reflecting part, the optical axis of said refracting optical part being bent at an appropriate angle in a horizontal plane containing the optical axis of said reflecting part.

16. The image display device according to claim 1, wherein said projecting optical means is provided with path-bending means for reflecting said optical image signal from first lens means to second lens means.

17. The image display device according to claim 1, wherein said

refracting optical part has at least one lens formed of synthetic resin.

18. The image display device according to claim 1, wherein said refracting optical part and said reflecting part are rotationally symmetric about an optical axis made common to them.

19. The image display device according to claim 1, which further comprises a plane mirror for reflecting said optical signal from said projecting optical means to said display means.

20. The image display device according to claim 19, wherein a light receiving surface of said display means and a reflecting surface of said plane mirror are held in parallel to each other.

21. The image display device according to claim 1, wherein said refracting optical part comprises:

a retro-focus optical system composed of a positive lens group of positive power and a negative lens group of negative power; and

a refracting optical lens for fine-tuning the angle of emission of said optical image signal from said retro-focus optical system to said reflecting part.

22. The image display device according to claim 21, wherein said retro-focus optical system is composed of two positive lens groups and one negative lens group.

23. The image display device according to claim 21, wherein said retro-focus optical system is composed of one positive lens group and one negative lens group.

24. The image display device according to claim 12, wherein said refracting optical part comprises:

negative lenses having an average value of refractive indexes in the range of 1.45 to 1.722 and having negative power; and

positive lenses having an average value of refractive indexes in the range of 1.722 to 1.9 and having positive power.

25. The image display device according to claim 12, wherein said refracting optical part comprises:

negative lenses having an average value of Abbe's number in the range of 25 to 38 and having negative power; and

positive lenses having an average value of Abbe's number in the range of 38 to 60 and having positive power.

26. The image display device according to claim 12, wherein said refracting optical part comprises positive lenses made of refractive materials and negative lenses made of refractive materials, the difference between average refractive indexes of said refractive materials for said positive and negative lenses is in the range of 0.04 to 1.

27. The image display device according to claim 12, wherein said refracting optical part comprises positive lenses made of refractive materials and negative lenses made of refractive materials, the difference between average Abbe's number of said refractive materials for said positive and negative lenses is in the range of 0 to 16.

28. The image display device according to claim 1, wherein a back focal length from the closest one of a plurality of lenses forming said refracting optical part to a light emitting surface of said transmitting means to said light emitting surface is equal to the distance from said light emitting surface of said transmitting means to the position of an entrance pupil of said refracting optical part.

29. The image display device according to claim 1, wherein said projecting optical means has negative lenses of negative power provided at the position of low marginal ray.

30. The image display device according to claim 15, wherein the angle of bending the optical axis of said refracting optical part is set such that said refracting optical part is as close to a path from said path-bending means to said reflecting part as possible without intercepting said optical path.

31. The image display device according to claim 16, wherein the angle of bending the optical axis of said first lens means is set such that said first lens means is as close to a path from said path-bending means to said second lens means as possible without intercepting said optical path.

32. The image display device according to claim 16, wherein the longest distance from said refracting optical part to a reflecting part placement plane is chosen within a range smaller than a thickness limiting value.

33. The image display device according to claim 30, wherein the longer one of the longest distance from a reflecting part placement plane to said path-bending means and the longest distance from said reflecting part placement plane to said refracting optical part is equal to a thickness limiting value.

34. The image display device according to claim 30, wherein the longest distance from a reflecting part placement plane to said path-bending means and the longest distance from said reflecting part placement plane to said refracting optical part are equal to each other.

35. The image display device according to claim 30, wherein said refracting optical part has a shape obtained by removing a non-transmitting portion that does not transmit said optical image signal.

36. The image display device according to claim 1, wherein said reflecting part has a shape obtained by removing a non-reflecting portion that does not reflect said optical image signal to said display means.

37. The image display device according to claim 1, which furthe

comprises a retaining mechanism for retaining said refracting optical part and said reflecting part as a one-piece structure.

38. The image display device according to claim 15, which further comprises a retaining mechanism for retaining said refracting optical part, said path-bending means and said reflecting part as a one-piece structure.

15 39. The image display device according to claim 1, wherein said refracting optical part has positive lenses of positive power provided at the position of high marginal ray.

40. The image display device according to claim 1, wherein, letting hi represent the height of the marginal ray of light incident to said refracting optical part, hm the maximum height of the marginal ray in a positive lens disposed at the center of said refracting optical part and ho represent the height of the marginal ray of light emitted from said refracting optical part, said refracting optical part satisfy the relationships 1.05hi<hm<3hi and 0.3hi<ho<1hi.

41. The image display device according to claim 1, wherein said projecting optical means has poor optical performance in an unused area around its optical axis but has high image formation performance in an area to be used other than that around said optical axis.

42. The image display image according to claim 41, wherein said projecting optical means is adapted so that an image-forming position at the center of said optical axis and an image-forming position around said optical axis are not in the same plane.

43. The image display device according to claim 41, wherein said projecting optical means allows distortion in the vicinity of the center of said optical axis to increase the image formation performance of said area to be used.

44. The image display device according to claim 41, wherein said projecting optical means limits the range of degradation of the optical performance to the range of the field angle related only to the base of a screen.

45. The image display device according to claim 43, wherein a plane mirror for reflecting said light from said projecting optical means to said display means has a surface configuration that corrects for distortion of said projecting optical means.

46. The image display device according to claim 1, wherein said refracting optical part has a construction in which an exit pupil of light emitted toward the central area of said reflecting part around the optical axis thereof and an exit pupil of light emitted toward the peripheral area of said reflecting part are spaced apart to thereby adjust the position and angle of incidence of said emitted light toward said reflecting part.

47. The image display device according to claim 1, wherein said reflecting part has a uniform thickness from its front surface as a reflecting surface for reflecting said optical image signal to the rear surface provided behind said front surface.

48. The image display device according to claim 1, wherein said reflecting part has a planar low-reflectivity surface provided on a non-projecting front surface about the optical axis of said reflecting part and a planar high-reflectivity surface smaller in area than said low-reflectivity surface and provided in said low-reflectivity surface about said optical axis.

49. The image display device according to claim 1, wherein said transmitting means is provided with a cover glass for protecting an image information light emitting surface and a compensator glass of an optical thickness that decreases or increases as a change in the optical thickness of

said cover glass increases or decreases, said transmitting means emitting said image information light to said refracting optical part through said cover glass and said compensator glass.

50. The image display device according to claim 49, wherein said refracting optical part is provided with means for detachably mounting said compensator glass on the side of incidence of said illumination light from said transmitting means.

51. The image display means according to claim 20, which further comprises a bottom perpendicular to said reflecting surface of said plane mirror and said light receiving surface of said display means, and wherein an optical component is disposed in a space defined by segments joining: a first point present on the base of a square image displayed on said display means and the farthest from the center of said image; a second point on said plane mirror to which light toward said first point is reflected; a third point on said reflecting part to which light toward said second point is reflected; a first projected point by projecting said first point to said bottom from the direction normal to said bottom; a second projected point by projecting said second point to said bottom from the direction normal to said bottom; and a third projected point by projecting said third point from the direction normal to said bottom.

52. The image display device according to claim 51, wherein said transmitting means comprises:

a converging optical system principal part composed of: an illumination light source part for emitting illumination light; a color wheel for coloring emitted light from said illumination light source part in three primary colors one after another; a rod integrator for receiving said illumination light from said illumination light source part and for emitting illumination light of a

uniform illuminance distribution from a light emitting surface; and a relay lens for relaying said illumination light from said rod integrator;

a field lens for directing principal rays of said illumination light from said relay lens to the same direction; and

a reflecting type image information providing part for providing image information to said illumination light from said field lens;

wherein said converging optical system principal part is disposed as said optical component in said space, and is further provided with second and third path-bending means for reflecting said illumination light from said converging optical system principal part to said field lens.

53. The image display device according to claim 52, wherein the optical axis of said converging optical system principal part is parallel to said light receiving surface of said display means and said bottom.

54. The image display device according to claim 52, wherein the optical axis of said converging optical system principal part is parallel to said light receiving surface of said display means and is tilted so that the intersection point of said illumination light source part and said optical axis is higher than the intersection point of said relay lens and said optical axis in the vertical direction.

55. The image display device according to claim 54, wherein said transmitting means is provided with an adjustment table for mounting said converging optical system principal part and said field lens, said adjustment table having a hole for receiving said third path-bending means.

56. The image display device according to claim 52, wherein at least one of said second and third path-bending means has a curved optical surface.

57. The image display device according to claim 1, wherein said reflecting part is made of synthetic resin.

58. The image display device according to claim 57, wherein said reflecting part is rectangular in front configuration viewed form the direction of its optical axis, a nonreflecting portion of said reflecting part that does not reflect said optical image signal to said display means being removed, and wherein said reflecting part is provided with: a first screwing part provided on the lower side of said rectangular front configuration close to but spaced a predetermined eccentric distance apart from the optical axis of said reflecting part and pivotally secured to a first reflecting part mounting mechanism; a second screwing part provided on another side of said rectangular front configuration and slidably held on a second reflecting part mounting mechanism; and a third screwing part provided still another side of said rectangular front configuration and slidably secured to a third reflecting part mounting mechanism.

59. The image display device according to claim 58, wherein said first reflecting part mounting mechanism and said first screwing part are screwed together by a taper screw and each have a screw hole conforming to a tapered portion of said taper screw.

60. The image display device according to claim 57, wherein said reflecting part is rectangular in front configuration viewed form the direction of its optical axis, a nonreflecting portion of said reflecting part that does not reflect said optical image signal to said display means being removed, and wherein said reflecting part is provided with: a recess provided on the lower side of said rectangular front configuration close to but spaced a predetermined eccentric distance apart from the optical axis of said reflecting part; a cylindrical support for engagement with said recess; two springs fixed at one end to said reflecting part on both sides of said recess, for biasing said reflecting part; a second screwing part provided on another side of said

rectangular front configuration and slidably held on a second reflecting part mounting mechanism; and a third screwing part provided still another side of said rectangular front configuration and slidably secured to a third reflecting part mounting mechanism.

61. The image display device according to claim 57, wherein said reflecting part is rectangular in front configuration viewed form the direction of its optical axis, a nonreflecting portion of said reflecting part that does not reflect said optical image signal to said display means being removed, and wherein said reflecting part is provided with: protrusion provided on the lower side of said rectangular front configuration close to but spaced a predetermined eccentric distance apart from the optical axis of said reflecting part; a V-grooved support having a V-shaped groove for engagement with said protrusion; two springs fixed at one end to said reflecting part on both sides of said protrusion, for biasing said reflecting part; a second screwing part provided on another side of said rectangular front configuration and slidably held on a second reflecting part mounting mechanism; and a third screwing part provided still another side of said rectangular front configuration and slidably secured to a third reflecting part mounting mechanism.

62. The image display device according to claim 58, wherein said reflecting part is provided with two springs fixed at one end to said reflecting part on both sides of said first screwing part and at the other end to a common point, for biasing said reflecting part.

63. The image display device according to claim 58, wherein said first, second and third screwing parts hold said reflecting part with its reflecting front surface in contact with said first, second and third reflecting part mounting mechanisms.

64. The image display device according to claim 37, which further comprises:

two sliding supports mounted on said retaining mechanism, for slidably supporting all or some of lenses of said refracting optical part;

a first mounting plate disposed between said two sliding support and fixed to said retaining mechanism;

a second mounting plate disposed between said two sliding supports and fixed to the lower ends of all or some of said lenses of said refracting optical part; and

a piezoelectric element held between said first and second mounting plates and expanding or contracting in the direction of the optical axis of said refracting optical part as a control voltage applied to said piezoelectric element increases or decreases.

65. The image display device according to claim 37, wherein witch further comprises a gear mechanism supported on a gear support provided on said retaining mechanism, for moving said reflecting part, or all or some of lenses of said refracting optical part in the direction of the optical axis of said refracting optical part.

66. The image display device according to claim 37, which further comprises a heater/cooler for heating/cooling at least one of said refracting optical part held on said retaining mechanism and said retaining mechanism.

67. The image display device according to claim 64, which further comprises: a temperature sensor for sensing a lens-barrel temperature of said refracting optical part; a temperature sensor for sensing the internal temperature of said retaining mechanism; and a control unit for controlling at least one of said piezoelectric element, said gear mechanism and said heater/cooler according to a focus-compensation amount calculated from said

lens-barrel temperature and said internal temperature.

68. The image display device according to claim 64, which further comprises: a temperature sensor for sensing an environmental temperature; and a control unit for controlling at least one of said piezoelectric element, said gear mechanism and said heater/cooler according to a focus-compensation amount calculated by adding said environmental temperature to a linear interpolation equation derived from at least two different focus adjustment points.

69. The image display device according to claim 64, which further comprises: a CCD for detecting focus information from light to be incident to a non-image-display area of said display means; and a control unit for controlling at least one of said piezoelectric element, said gear mechanism and said heater/cooler according to the result of analysis of said focus information.

70. The image display device according to claim 69, which further comprises a miniature reflector for reflecting to said CCD said light to be incident to said non-image-display area of said display means.

71. The image display device according to claim 69, wherein said control unit regards the intensity distribution of said light received by said CCD as focus information, analyzes a peak value of said focus information and effects control to increase said peak value.

72. The image display device according to claim 69, wherein said control unit regards the intensity distribution of said light received by said CCD as focus information, analyzes the width of a predetermined level of said focus information and effects control to decrease the width of said predetermined level.

73. The image display device according to claim 69, wherein said

control unit regards the intensity distribution of said light received by said CCD as focus information, analyzes the inclination of a shoulder of said focus information and effects control to increase said inclination.

74. The image display device according to claim 37, wherein said retaining mechanism is provided with a plurality of supports for supporting said refracting optical part and said reflecting part, said plurality of supports having the same product of their height and coefficient of linear expansion.

75. The image display device according to claim 48, wherein said reflecting part has a high- or low-reflectivity surface, or a reflecting protrusion or reflecting recess that is high-reflectivity over the entire area of its reflecting surface.

76. The image display device according to claim 1, wherein said reflecting part has a lens layer covering its front surface for reflecting said optical image signal.

77. An image display device comprising:

a cabinet front portion provided on the bottom of a cabinet and having display means;

a cabinet rear portion provided on said bottom; and

upper slanting surface, a left-hand slanting surface and right-hand slanting surface provided between said cabinet front portion and said cabinet rear portion and defining a housing space together with said bottom;

wherein said left- and right-hand slanting surfaces leave left- and right-hand parallel surfaces parallel to said display means on the back of said cabinet front portion and perpendicular surface perpendicular to said display means on both side of said cabinet rear portion.

78. The image display device according to claim 77, which further comprises a connector having a first end face for connection with either one

of said left- and right-hand parallel surfaces, a second end face for connection to that one of said perpendicular surfaces on the same side of said either one of said parallel surfaces, and a connection face parallel to said second end face;

wherein said connection surface is coupled to a connection face of another connector.

79. The image display device according to claim 78, wherein said connector has the same height as that of said image display device and is provided with a third end face perpendicular to said first and second end faces, for connection to said another connector.

80. The image display device according to claim 77, wherein air and heat are discharged or cables are extended out of said cabinet through said upper, left- and right-hand slanting surfaces.

81. A method of adjustment for correct alignment between a refracting optical part rotationally formed about an optical axis for exerting a lens action on light and a reflecting part rotationally formed about said optical axis for reflecting said light and having a planar high-reflectivity surface provided around said optical axis, said method comprising the steps of:

applying rectilinearly propagating light to said reflecting part and adjusting the attitude of said reflecting part so that the outgoing path of said rectilinearly propagating light for incidence to said high-reflectivity surface of said reflecting part and the incoming path of said rectilinearly propagating light reflected by said high-reflectivity surface come into alignment with each other; and

applying the rectilinearly propagating light on said outgoing path to said high-reflectivity surface of said reflecting part through said refracting optical part, emitting from said refracting optical part the rectilinearly

propagating light on said incoming path reflected by said high-reflectivity surface and adjusting the attitude of said refracting optical part to maximize the power of said rectilinearly propagating light emitted from said refracting optical part.

82. A method of adjustment for correct alignment between: an illumination light source part for emitting illumination light; an image information providing part for providing image information to said illumination light and emitting an optical image signal; a refracting optical part rotationally formed about an optical axis, for exerting a lens action on said optical image signal; path-bending reflector for reflecting said optical image signal from said refracting optical signal; a reflecting part rotationally formed about said optical axis, for reflecting said optical image signal from said path-bending reflector, said reflector having a planar high-reflectivity surface provided around said optical axis; and jig display means for receiving said optical image signal from said reflecting part to display an image, said jig display means having a first through hole made in alignment with said optical axis; said method comprising the steps of:

reflecting a bundle of parallel rays, applied perpendicularly to said jig display means and having passed through said first through hole, by said high-reflectivity surface of said reflecting part to bring outgoing and incoming paths of said bundle of parallel rays into alignment between said high reflectivity surface and said first through hole;

reflecting a bundle of parallel rays about an ideal optical axis of said refracting optical part by said path-bending reflector to said high-reflectivity surface to bring outgoing and incoming paths of said bundle of parallel rays into alignment between said high-reflectivity surface and said path-bending reflector;

mounting, on a lens-holding flange, a holed reflector having a second through hole made in alignment with the optical axis of said refracting optical part, and reflecting a bundle of parallel rays about an ideal optical axis of said refracting optical part by said path-bending reflector to said high-reflectivity reflector through said second through hole, by which the direction of travel of said bundle of parallel ray reflected by said holed reflector and the direction of travel of said bundle of parallel rays on an incoming path reflected by said high-reflectivity surface to said path-bending reflector are brought into coincidence with each other;

removing said holed reflector from said lens-holding flange and placing said refracting optical part on said lens-holding flange instead; and

placing said illumination light source part and said image information providing part at predetermined positions, rendering said illumination light from said illumination light source part by said image information providing part to said optical image signal, and applying said optical image signal via said refracting optical part, said path-bending reflector and said reflecting part to said jig display means to form an image of said optical image signal on said jig display means at a normal position.

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